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WINTER FORAGE CROPS FOR THE SOUTH.

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U. S. DEPARTMENT OF AGRICULTURE,
BUREAU OF PLANT INDUSTRY,
OFFICE OF THE CHIEF,
Washington, D. C., January 10, 1902.

SIR: I have the honor to transmit herewith a paper on Winter Forage Crops for the South, and respectfully recommend that it be published as a Farmers' Bulletin. The paper was prepared by Mr. Carleton R. Ball, Assistant Agrostologist, and was submitted by the Agrostologist.

Respectfully,

B. T. GALLOWAY,
Chief of Bureau.

Hon. JAMES WILSON,
Secretary of Agriculture.

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WINTER FORAGE CROPS FOR THE SOUTH.

INTRODUCTION.

The question of winter forage and pasturage is one of the greatest importance in the southern United States. Ever since the organization of the Division of Agrostology inquiries have been frequent concerning the best methods of securing the desired sustenance for all kinds of stock. Experiments along these lines have been carried on by most of the agricultural experiment stations in that part of the country. This office has also conducted similar experiments in cooperation with private parties and with some of the State experiment stations. During February and March of the present year the writer spent several weeks in an investigation of the winter forage conditions and problems presented in several of the Gulf States. Other members of the office staff have made observations on different phases of this problem in the course of field work done in the South.

CONDITIONS PAST AND PRESENT.

For the greater part of the region under discussion it is probable that during the summer season live stock will make a desirable growth and gain on the forage which is readily available for them. For three months of the remaining half year they will about hold their own with the same resources. For the other three months they will need assistance in the way of forage crops especially fitted for use during that season.

Live stock have always been maintained in considerable numbers throughout the Southern States. Until recently little attention has been paid to their feed, but with the progressive development of all agricultural industries of the South arose the desire for a more intelligent system of stock feeding. Small dairies sprang up here and there with a need for food stuffs that would keep up the supply of milk throughout the entire twelve months. The Jersey cow became a frequent sight in both town and country. The home production of beef cattle became a very desirable end in the view of many planters. The

scrubby native stock began to be replaced by thoroughbred or graded stock of several of the best beef or combination breeds. With the increase in the number and importance of horned cattle came an increasing demand for an abundant winter pasture. Since the cattle were able to provide forage for themselves during so large a part of the year with so little trouble or expense to their owners, it was only natural that the latter should strongly desire that the same conditions might obtain throughout the year. It became gradually recognized that for dairy and beef production a continuous grazing on even the best of pasture crops was not sufficient. It was also realized that there was little likelihood of economically obtaining a winter pasturage which could be depended upon for the full rations of grazing stock during the colder months. The necessity of producing hay or some other forage as well as providing the more concentrated feeds became increasingly apparent.

At the present time the outlook is very encouraging. The increase in the number of graded stock continues. Dairying on practical scientific lines is found to be a profitable business near all of the larger towns and cities. More cattle are fattened for market each year and more good mules and horses raised for farm and breeding purposes. This extension of the work in the live-stock industry creates a larger demand for good forage and feeding stuffs and for approved and profit-making methods of using them. Almost without exception the experiment stations are conducting investigations with reference to breeds best adapted to the Southern soil and climate, and most profitable for the different ends in view. Experiments as to the nutritive value of the different classes of forages and feeding stuffs are being conducted. These tests carry the animal through from birth until the meat is finally placed on the market, and the economic aspects of the entire transaction are considered with reference to the different methods of stock raising. These results are placed before the planters, and they in their turn are adapting these results to their conditions, or changing their conditions where necessary in order to secure better results.

CLIMATE.

The climatic conditions of this region are quite favorable to the economic production of forage and the growing of stock. The annual rainfall varies from about 60 inches on the immediate Gulf coast to between 40 and 50 in the upland portions. It is usually well distributed throughout the year. The winters are so mild and open that stock require but little shelter from the weather. The following table shows the average winter temperature in degrees Fahrenheit for the months of December, January, and February at latitudes 30°, 33°, 36°, 39°, 42°, 45°, 48°, 51°, 54°, 57°, 60°, 63°, 66°, 69°, 72°, 75°, 78°, 81°, 84°, 87°, 90°.

and 36°. Several of the larger cities on or near these different parallels are given in order that the table may be more readily understood:

Average winter temperatures on three Southern latitudes.

Region.	December.	January.	February.	Average.
	°F.	°F.	°F.	°F.
Latitude 30° N. (Jacksonville, Fla.; New Orleans, La.; Galveston, Tex.)	55	52	58	55
Latitude 33° N. (Savannah, Ga.; Montgomery, Ala.; Vicksburg, Miss.; Shreveport, La.)	50	47	50	49
Latitude 36° N. (Norfolk, Va.; Nashville, Tenn.; Fort Smith, Ark.)	45	42	44	43.7

It will be noted for the Gulf coast the average for these three months of winter is 55° F., while for the latitude of Tennessee and northern Arkansas the average is only about 44° F. Temperatures which average no lower than these do not preclude a vigorous growth of hardy forage plants during the winter. Of course the mercury sometimes falls to the freezing point even on the Gulf coast, and this happens more frequently and with greater severity as we pass northward, but most of the winter forage crops recommended are entirely hardy; so that while their growth will be checked by the lower temperature they will not be killed.

FORAGE RESOURCES.

It will be noted that the possibilities for producing green forage during winter under the above climatic conditions are very good; and the demand for winter pasture crops has been constantly increasing. At first this was due to the realization of the needs for better and larger winter rations for all kinds of stock. All except such as were at work subsisted during the larger part of the year on the natural grazing. There was an evident desire that sufficient grazing be obtained to support them through the entire year. This view of the matter has been very largely discouraged by practical experience of the farmers themselves, as well as by the opinions of those who have carried on more extensive experiments along this line. Every attempt to increase the quantity and quality of the winter pastures should be, and is, heartily encouraged, but they should not be regarded as the sole forage resource during winter. The combination of hay, silage, and root crops with winter grazing is the one which must prove the most successful and profitable winter ration for dairy and beef cattle. This will be, of course, in addition to any grain foods that are employed. Young and growing stock may obtain a larger proportion of their winter food from pastures than would be possible or advisable for stock intended for work purposes or the production of milk and beef.

HAY.

The production of Southern hay has been a question long under discussion. The amount produced and the yield per acre have both increased steadily and encouragingly during the last few years. On every hand it is admitted that it is both possible and necessary to raise all that is needed for home consumption. Alfalfa, Bermuda grass, Johnson grass, crab grass, and cowpeas furnish an abundance of hay of the very best quality. This hay can be produced much more cheaply than an equal quality can be shipped in from Northern or Western States. With better transportation facilities and an increasing demand the production will become more and more profitable. At the same time, with hay raised on the home plantations, and hence cheaply and readily available, larger quantities are being used in feeding the plantation stock.

SILAGE.

Silage crops, such as corn, sorghum, the nonsaccharine sorghums, cowpeas, etc., can be so easily and abundantly raised in the South that they should be more commonly used than is now the case. It is true that the equipment for putting up silage is more expensive than that required in preserving forage in other forms. At the same time silos have been proved profitable investments on all large stock and dairy farms. These silage crops can be utilized for green feeding during the late summer and autumn, if desired, as well as for filling the silo itself. In feeding value silage approaches more nearly to green forage than does hay.

ROOT CROPS.

The various root crops are much in the nature of green food, and hence are valuable not only for the food they supply but also for their general tonic effect during the winter season. A small quantity of such feeding stuffs as these will enable stock to winter in much better condition than would otherwise be the case where no green food is obtainable. Without doubt, turnips, carrots, and mangels could be readily grown and profitably utilized for this purpose. Comparatively little has been done toward determining how extensively these crops can be grown in the Southern States. Some of the semi-tropical plants, adapted only to the warmer regions, have been made the subject of experiments. Among these are taro (*Colocasia anti-quorum*) and cassava (*Manihot aipi*), the latter having a very high feeding value.

WINTER PASTURES.

In this region a much larger proportion of the pastures, both summer and winter, are annual or temporary in their nature than is

the case in the North. A permanent pasture requires a perennial plant or plants. Valuable perennial species adapted to the warmer climates are not as numerous as those that thrive best in cooler latitudes. The demand for such perennial species is constantly increasing.

Certain wild species of the Southern States might well be brought under experimental cultivation to determine their possible value for meadows and pastures, and some species have already been found of value for this purpose. Others have been noted as possessing valuable qualities in their native situations, but no attempt has ever been made to domesticate them.

A number of plants, either native or accidentally introduced, have been shown to be of great value for pasturage. A larger number of well-known grasses and leguminous forage plants have been proved to adapt themselves in a greater or lesser degree to winter conditions in the South. The most valuable species belonging to the two great groups of grasses and legumes have been brought together here in an alphabetical arrangement and discussed at length individually. Any planter wishing to start winter pastures, either temporary or permanent, should, in considering the species discussed in the following pages, select for his use the ones best adapted to his soil and climate. These may not always be the ones which give the greatest yield or the most vigorous growth during the winter months.

In considering the question of winter pastures there is another point which should be kept in mind. This is the washing and leaching to which all soils are exposed when left uncovered during any part of the year. Most of the fields of the Southern States lie in this condition during the winter months. The amount of damage done will depend upon the mechanical condition of the land, the amount of rainfall, and the slope of the surface. Light soils, especially on hillsides, will be badly gullied by the flowing of the water, at the same time the soluble plant foods are washed out and carried away. Terracing, however carefully done, will not entirely eliminate these injurious effects. Any winter crop which holds these naked soils prevents most of this loss, and if it be turned under in the spring the fertility exhausted by the growing crop is restored to the soil. If during the winter it provides green forage or, as in the case of the leguminous crops, deposits atmospheric nitrogen in the soil, it is a double blessing to the owner of the field.

FORAGE CROPS: GRASSES**AWNLESS BROME.***(Bromus inermis* Leyss.)

This grass (fig. 1), also called Hungarian brome and smooth brome, is now well known as a most valuable hay grass, especially for the Northwest. It was introduced into the Southern States some ten

years ago or more, and in the small experimental plats at various stations it gave most excellent results. It was, therefore, very highly recommended for Southern latitudes. However, since that time it has been tried under field conditions throughout all that region and its behavior has often times been disappointing. Compared with rescue grass it will adapt itself to poorer and sandier soils and withstand more drought. While it has not proved so valuable as was hoped it is by no means a worthless grass. It is better suited for the drier and poorer upland soils than to those of a heavy, wet character. Its use is as a pasture grass rather than a hay crop. Where it grows successfully it is one of the best all the year round pasture

grasses. It is almost ever-



FIG. 1. Awnless brome (*Bromus inermis*).

green in habit, growing well during the entire winter. Fifty pounds of seed per acre are necessary to insure a good stand of this grass.

BERMUDA GRASS.*(Cynodon dactylon* Pers.)

Bermuda grass (fig. 2) is in no sense of the word a winter pasture or forage crop. It is true that the Florida variety, known as St. Lucie grass, has proved itself more resistant to frost than has the

ordinary Bermuda, thus enabling it to remain green from two to three weeks longer in the fall. Bermuda grass is inserted in this catalogue of winter forage crops only because where the planter has already a Bermuda grass meadow he may compel the land to yield him winter forage by combining this grass with some leguminous crop. The bur clover or hairy vetch will either one grow well in the Bermuda sod, if it be first run over with a disk or slant-toothed harrow so as to loosen the tangle of stems and prepare a place for the germination of the seed. A further discussion of this will be found under those species.

CANE AND SMALL CANE.

(*Arundinaria macrosperma* and
Arundinaria tecta.)

These two very closely related and similar species form the immense cane-brakes of the South. The first named (fig. 3) is the larger, often attaining a height of fifteen to thirty feet, with a proportionately large tree-like stem. The small cane rarely exceeds twelve to fifteen feet in height, but is very similar in its habit of growth. These grasses send their long roots deep into the rich moist soil in which they grow, and are thus enabled to secure an abundance of plant food. They continue their growth



FIG. 2. Bermuda grass (*Cynodon dactylon*).

throughout the entire season, and by their large size, and close, dense habit of growth, furnish not only food, but shelter as well, to the herds of stock which range in them. They are both of the highest value to the planter for this purpose. They are both indigenous to the very richest soils of the South, and for that reason have been rapidly encroached upon by the demands of agriculture. Although they prefer moist soils, they can not stand long inundations, and hence immense areas have been killed out by the disastrous floods of

recent years. For these reasons they are no longer so important an item in the problem of winter forage as they once were. Indeed, in the earlier days they furnished the entire winter food of many thousands of cattle. They are not adapted to cultivation, and, as before stated, their area has been largely reduced.

CEREALS.

The common cereal crops—oats, wheat, rye, and barley—are all used for winter pasture crops, but few experiments have been made to

determine their relative value for pasturage, hay, soiling, or green manuring. The question of comparative values for these uses should influence the planter in his selection, no doubt, but usually he plants as is most convenient to himself at the time.

Oats.—Of the four cereals mentioned, oats are used more extensively than all of the others combined. They are the most commonly raised for the sake of the seed, as the winter pasturage is usually a secondary consideration in the matter. This crop is usually the one sown for the combined purpose. At the State agricultural experiment stations of Mississippi and Alabama more than 100 acres of the station farms are annually seeded down to a mixture of oats and hairy vetch. A portion of this area, usually about half, is used for pasture purposes entirely, the remainder for the production of a



FIG. 3.—Cane (*Arundinaria macrosperma*).

large and valuable hay crop. In the warmer portions of the Southern States, especially those lying directly along the Gulf, it is possible to secure one or even two cuttings of hay from the oats field before allowing the grain to ripen its seed for harvest. The oats crop, where sown with hairy vetch, can be made to reseed itself in the same manner as does the vetch if the harvest is delayed until the oats are fairly ripe,

so that some seed will scatter during harvesting. Ordinarily, however, the object is to cause the reseeding of only the vetch crop. The vetch seed is of course much more expensive than the oats, and it is therefore very desirable to reseed the land each year from the seed of the growing crop. This can be done very successfully, while it is more difficult to get a satisfactory stand of oats from self-sown seed after the cultivation of some summer crop. Then, too, it is desirable to cut the oats before they are ripe if they are to make the best quality of hay. Oats draw very heavily upon the plant food contained in the soil, and of course need a well-fertilized soil. They should always be followed by some fertilizing leguminous crop, such as cowpeas. By growing the hairy vetch with oats not only is a better pasture secured, but a certain amount of fertility is being restored to the soil during the same period that it is being so heavily drawn upon by the growing oats. Either the turf oats or the ordinary winter oats will give good results for pastures. In favor of the turf oats it may be said that a smaller quantity of seed is needed and that it covers the soil a little more completely than does the ordinary oats. So far as the nutritive value is concerned there is probably little difference.

Wheat.—More wheat is being raised for seed now than was the case a few years ago. As this wheat is, of course, all fall sown, and as it continues its growth throughout the winter fairly well, it may be pastured in the same manner as oats with good results. Prof. R. L. Bennett, of the Arkansas Experiment Station, reports that it is a more satisfactory crop to use in combination with the hairy vetch than is oats. It matures more nearly at the same time as the vetch, is more resistant to cold and freezes, and is nearly as valuable a hay crop when cut early. He recommends the sowing of 2 pecks of wheat and 1 bushel of vetch seed per acre. During the month of February, 1901, the writer inspected a 7-acre field of wheat at the North Louisiana Experiment Station. It had been sown the preceding November, and had furnished pasturage for several calves and sheep throughout the winter. It was in a good vigorous condition, and evidently furnishing an abundant and excellent forage for these animals.

Rye.—Rye is also quite commonly used as a combination pasture and hay crop. On a dairy farm at Jackson, Miss., ten to fifteen acres of rye are sown each winter and used as a pasturage for about 25 head of cows. From it they get more than half of their winter food. About ten years ago the Alabama Experiment Station made some experiments as to the amount of forage furnished by rye during the winter. The crop was sown in drills 2 feet apart. The first cutting was made on October 30 and the fourth on February 27. The combined yield of these four cuttings, representing a growth of about five months, was a little over 10 tons of most excellent green forage. A

couple of years later two tests of the comparative food value of green rye and corn ensilage were made. Two lots of dairy cows were selected. One lot received, in addition to their regular corn ration, about 40 pounds of green rye per day, while the other lot received about 25 pounds of the corn ensilage. In both tests a decided increase of the milk flow in favor of the rye was noted.

Barley.—Barley is less frequently used as a winter pasturage than any of the other cereal crops mentioned. The Mississippi Station reports excellent grazing furnished by it. It is probably as nutri-

tious and palatable as the other cereals. It makes, however, a slow growth, and the yield of hay, as well as the amount of grazing furnished, would probably be considerably less than that obtained from the others. Professor Bennett of the Arkansas Experiment Station states that both barley and rye grow faster and mature two or three weeks earlier than the hairy vetch, and hence are not so profitable as wheat or oats to use in combination with that crop.

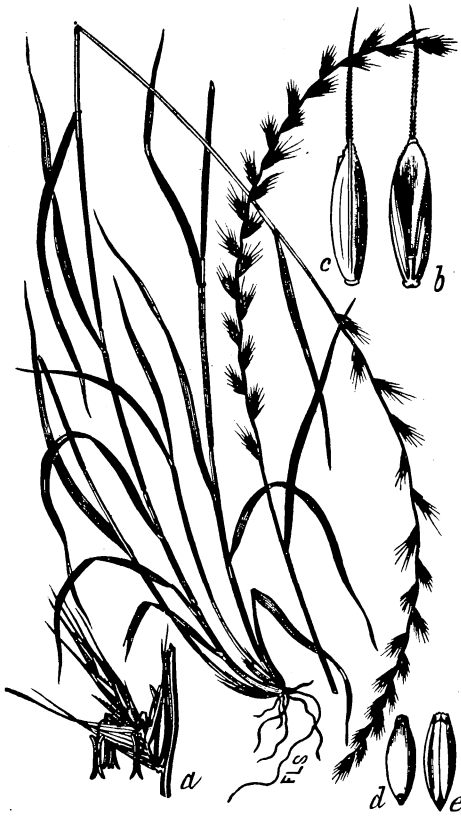


FIG. 4. Italian ray grass (*Lolium italicum*).

ITALIAN RAY GRASS.

(*Lolium italicum* L.)

This grass (fig. 4) is best adapted to damp but not wet soils. On the moist, rich, alluvial lands and calcareous loams it makes an excellent growth in winter and spring. It may be used as an annual plant or may be made to last

for two or even three years under cultivation. Seed should be sown in the fall at the rate of forty to fifty pounds per acre. It germinates quickly and makes an exceedingly rapid growth, sometimes producing a good crop in five or six weeks from date of germination. It will remain green and furnish considerable grazing throughout an ordinary winter in the South, and will provide an abundant crop of hay in March or April. It stands drought very well and maintains a fair growth during the summer months. It is of great value as a quick-

growing grass for the use of dairymen, etc. It may be maintained for several years by reseeding on the old sod every second year, using a disk or other sharp harrow for scarifying the sod. It can not be made to reseed itself satisfactorily.

KENTUCKY BLUE GRASS.

(*Poa pratensis* L.)

This grass (fig. 5), one of the most valuable for Northern meadows and pastures, does not do nearly as well in the South. On most moist dark-colored soils where there is an abundance of lime it makes a very good growth, but on heavy clays or on the poor sandy soils it has little value. It makes its greatest growth during the cool months of fall and during the winter, if it be not too severe. During the hot summer months it makes almost no growth. To be of the greatest value it should be combined with Japan clover or Bermuda grass, either of which grow excellently during the hottest weather.

LARGE WATER GRASS.

(*Paspalum dilatatum* Poir.)

This large, rather coarse grass (fig. 6), which is native to South America and probably to Central America as well, has been quite widely introduced in the Southern States, and grows so freely as to appear indigenous there. The roots are very long and strong, enabling the plant to obtain an

abundance of nourishment from the soil and also to withstand considerable drought. It produces an abundance of stems from a single root, thus making it grow in clumps very much as does orchard grass. As in the case of that species, however, this habit may be largely removed by seeding it thickly enough. It may be profitably combined with redtop, as it is best adapted to similar soils, i. e., those



FIG. 5. Kentucky blue grass (*Poa pratensis*).

of a low, moist, and rather rich alluvial nature. Under natural conditions it spreads very slowly, but it produces an abundance of seed, which may be quite easily gathered. It is always best to sow it quite thickly at the start. The leaves are very long and are produced in great abundance. It remains green all winter, uninjured except by the hardest of frosts. During the early spring the growth is very strong and rapid, and it bears grazing well. Stock do not appear to be very fond of it after it has attained more than a foot or 18 inches

in height, but if kept pastured down they seem to relish it well. On the whole, it may be considered one of the best of grasses for suitable soils in the South.

ORCHARD GRASS.

(*Dactylis glomerata* L.)

This well-known grass (fig. 7) has proved itself of considerable value for the rather heavy clay soils of the Southern States. It does not do well on the lighter sandy soils. Some objection has been made to it on account of its habit of growing in bunches, but as in the case of the large water grass, this habit may be overcome by seeding it thickly. When sown alone, 30 to 40 pounds of seed should be used; or it may be grown in combination with red clover, in which case 20 pounds of



FIG. 6.—Large water grass (*Paspalum dilatatum*).

the grass seed and 8 to 10 of clover are the proper amounts. It may also be mixed with meadow fescue or one of the ray grasses. During the hottest weather of the summer it usually makes but little growth, but with the fall rains it springs at once into life and furnishes an abundance of excellent grazing throughout the entire winter months. It may be pastured during the spring until the hot weather sets in, or if it is allowed to grow during those months it will yield a heavy crop

of hay. Growth during the spring and fall months is especially rapid, and it may be called a practically evergreen grass. When once established it is usually not much injured by hot weather, although the growth during those months may be very slow. It probably has much greater value for pasturage than for hay. The greatest success is usually obtained by sowing the seed in the fall, although for some of the more northern States it may be better to seed in the spring.

PERENNIAL RAY GRASS.

(*Lolium perenne* L.)

This grass (fig. 8) can not be strongly recommended for the



FIG. 8. Perennial ray grass (*Lolium perenne* L.).

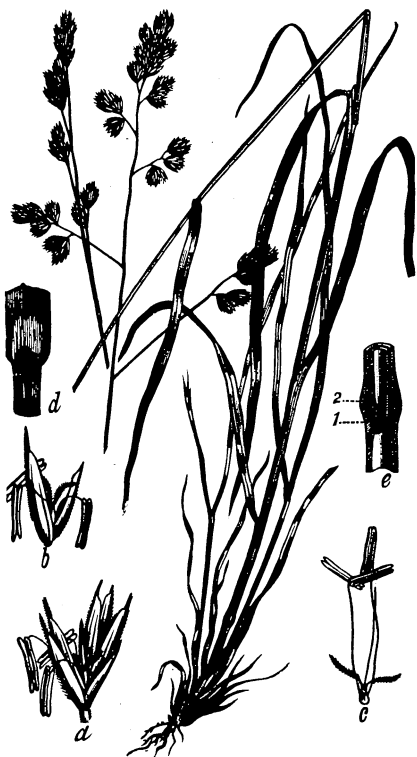


FIG. 7.—Orchard grass (*Dactylis glomerata*).

Southern States, although it has given good results, especially when used in mixtures with other hardier and more quickly growing species. It is adapted to moist, clayey soils in the cooler regions. Like the Italian ray, its greatest value is for quick returns. When sown alone, 2 or 3 bushels of seed should be used or one bushel in a mixture with some other grass. It ordinarily will not last more than three or four years in the Southern States. Its nutritive value is, according to some

experimenters, considerably lower than that of such grasses as orchard grass and meadow fescue.

REDTOP.*(Agrostis alba L.)*

Redtop (fig. 9), as is well known, is best adapted to low, moist, or wet soils, where it is of value for pasturage, hay, and soil binding. It should be sown in September or October at the rate of 9 to 10 pounds of seed per acre. It will make a fair growth through ordinary winter weather and a very rapid growth during the spring months. For the South its chief value would probably be for winter and early spring

grazing. It makes very palatable and nutritious hay, and a good crop can be taken from the land each spring. As it does not germinate very rapidly, and the growth at first is apt to be slow, it is often sown with one of the ray grasses for a nurse crop. These gradually disappear after the first year, while the redtop persists in abundance. It has been very highly recommended for the white crawfishy clays of north Louisiana, and certainly makes an excellent growth in such situations. It ought to be more widely introduced for winter forage as well as for the spring hay crop. It is often utilized for holding the soils on hill-sides liable to washing during the rainy season or as a means of filling ditches.



FIG. 9. Redtop (*Agrostis alba*).

RESCUE GRASS.*(Bromus unioloides Willd.)*

This grass (fig. 10) was introduced into South Carolina about

the year 1853. It has been very widely cultivated throughout the South, and has become pretty generally known among planters. It is best adapted to rich, loamy soils. On light and poor soils it is probably inferior to rye or oats as a winter grazing and spring hay crop. On all except the heavy, clayey soils it is probably a better grass than orchard grass. It should be seeded at the rate of 30 to 40 pounds early in the fall, preferably September. It makes a rapid growth during the fall, and continues it throughout the winter months, even ripen-

ing its seeds in March. On good soils or with a favorable season it can be cut once in the spring, and the second crop, or aftermath, be depended upon to furnish a good crop of seed. This seed should be allowed to mature and fall to the ground. It may be then turned under and the land sown in cowpeas or some other summer crop. The seeds of the rescue grass will lie dormant in the soil during the summer, and then germinate with the first autumn rains. If the summer crop is taken off in time to allow this, it is not difficult to make a meadow and pasture of this practically perennial grass by allowing it thus to reseed each season. It is said that where it is grazed closely it becomes a short perennial in character, persisting from one season to another by the living roots and not by the scattered seed in the soil. Under favorable conditions it will provide a heavy, luxuriant pasturage during the winter months. It should be widely utilized by those who desire to carry their stock through the winter on a part ration, at least, of green forage.

It is not infrequently mixed with hairy vetch and bur clover for winter pasture purposes, or it and the hairy vetch together may be sown in Bermuda grass sod and a continuous pasture furnished throughout the year.



FIG. 10. Rescue grass (*Bromus unioloides*).

SOUTHERN CANARY GRASS.

(*Phalaris caroliniana* Walt.)

This grass (fig. 11) is closely related to the common canary-grass used for bird seed. It is native to the Southern States, and is found abundantly near the Gulf coast from Louisiana to Florida. It is well adapted to all low, moist soils, and is of considerable importance as a

winter pasture plant. It has much less value for hay, as it does not form a close, even meadow. Its greatest use is for winter and early spring pastures. It is grazed quite readily by stock while it is young, and furnishes a considerable portion of the pasturage in its favorite localities. It heads out in April, and from that time until the next fall is of comparatively little value.

TALL FESCUE.

(*Festuca elatior.*)



FIG. 11. Southern canary grass (*Phalaris caroliniana*).

This grass and the meadow fescue (*Festuca pratensis*) are frequently confused by experimenters, and there is always considerable doubt as to just which of them is being recommended. It is suited to moist, rich, alluvial or somewhat clayey, soils. As it is rather inclined to grow in clumps, something like the orchard grass, it should either be sown very thickly, or perhaps, better still, in a mixture of other grasses, such as redtop, which is adapted to similar soils. Alsike clover might also be grown with it with good results. When sown alone about thirty-five pounds of seed per acre is the proper amount. It is entirely hardy, and furnishes considerable winter grazing. It matures quite early in the spring,

and may be cut for hay, of which it produces a large amount of good quality.

TALL OAT GRASS.

(*Arrhenatherum elatius* (L.) Beauv.)

This (fig. 12) is a most excellent grass for rather light and dry, loamy, upland soils. When sown alone 30 to 40 pounds of seed are used. Best results are obtained from sowing in the fall, during the months of September and October. It makes its best growth early in the spring, and will mature a very early crop of hay. It is, how-

ever, a perennial and practically an evergreen grass in the Southern States. It furnishes a good pasture in both winter and summer, stands drought fairly well and the hay is very readily cured. It matures as early as orchard grass.

TEXAS BLUE GRASS.

(*Poa arachnifera* Buckley.)

This blue grass (fig. 13) is a native of the State of Texas, and is best adapted to rich and not too heavy soils. It is perennial, forming a compact sod by means of very numerous suckers which it throws out. It produces an abundance of seed but is quite difficult to start in this way. Meadows are usually set by cutting up the sods and planting them in much the same manner as Bermuda sod. It spreads, however, much more slowly than does Bermuda. It is decidedly a winter-growing species, greening out about October, and furnishing an abundant pasturage until early spring. It has done fairly well in a number of localities in the South, although it has not seemed adapted to a general distribution over the Southern States. Soils intended for this grass should be well fertilized and well prepared mechanically, with good drainage. When once established it will stand the considerable tramping incident to pasturing.



FIG. 12. Tall oat grass (*Arrhenatherum elatius*).

VIRGINIA RYE GRASS.

(*Elymus virginicus* L.)

This well-known grass (fig. 14) is found commonly throughout the entire eastern half of the United States. It is adapted to rather moist and often shaded soils, growing usually in the edges of thickets and along the river banks throughout its range. It has received but very

little attention in cultivation. It is usually entirely hardy in the southern winters and makes a vigorous growth during the fall and winter months. It matures very early in the spring, but as it grows under its natural conditions quite thinly scattered, the stems are apt to be large and the quantity of forage rather small. By seeding thickly this could be remedied under cultivation, and a good quality of hay secured. It is a perennial, but makes no growth during the summer, and can not be pastured during those months.

FORAGE CROPS: LEGUMES.

ALFALFA.

(*Medicago sativa* L.)

The subject of alfalfa growing in the Southern States has been very fully discussed in the bulletins of the different experiment stations, and

is now quite generally understood by planters. Alfalfa (fig. 15) is a perennial plant, and a meadow once established may be expected to yield profitable returns for a great many years. Anyone wishing to use this crop as a winter forage should establish it with the other object in view; that is to say, it would not be profitable to sow alfalfa as one does crimson clover, simply for the sake of the winter pasture and cover crop and one cutting of hay, or green manure to be turned under in the spring. It may be said, briefly, that alfalfa requires thoroughly drained soil and a well-prepared seed bed, and, for the South, an early fall sowing of 20 to 25 pounds per acre. Sown in September it makes some growth the first fall, and thus is prepared to compete successfully with weeds the following spring.

After the field is more than



FIG. 13. Texas blue grass (*Poa arachnifera*).

one year old it will be safe to pasture it to some extent during the winter if desired. There is no more nutritious and palatable pastur-

age than that afforded by alfalfa, winter or summer. In the month of February, 1901, the writer had occasion to visit several large fields of this plant in the States of Mississippi and Louisiana. In most of them the plants were fresh and green, 4 to 5 inches in height. Cattle, horses, and mules were observed grazing upon them in many instances. There is no need to discuss the great value of alfalfa as a hay crop and soil renovator wherever it can be grown in the South. The fact that it furnishes a small amount of winter grazing is only an additional point in its favor.

BUR CLOVER.

(*Medicago denticulata* Willd.)

This little plant (fig. 16) is not a true clover, but is most closely related to alfalfa. It is much inferior, however, to alfalfa in actual feeding value, and also because it is an annual. It was introduced from the Mediterranean region into the Southern States, California, and the semiarid region of the Southwest. It has now become quite widely established throughout that portion of the country.

Its great use throughout the South is as a pasture plant rather than as hay. Ordinarily it does not grow tall enough to make a very large crop of hay, and the hay is not relished by stock, although they will eat it if nothing better can be had. As a winter pasture, however, it is of very considerable value. It is best adapted to light but rich soils, and can be raised anywhere that Bermuda will grow. A winter pasture may be made on well-prepared ground of this character by seeding in October at the rate of 15 to 20 pounds of clean seed per acre. The plant begins its growth with the autumn rains and continues to grow throughout the winter months. Sheep and cattle are very fond of it, and for them it makes an excellent pasturage. Horses and mules do not graze it readily, but will in time become accustomed to it. Hogs also will graze upon bur clover with relish. If it is used as a sheep pasture it must be kept closely grazed, as wherever the burs are allowed to form they become freely entangled in the wool, and the value of the fleece is diminished thereby. It continues its growth until April or



FIG. 14. Virginia rye grass (*Elymus virginicus*).

early May, at which time it seeds very freely and dies. Where it is used as a pasture it will reseed itself freely if not grazed too heavily during the late spring, when the seed is ripening. The land can then

be plowed and cultivated in some summer crop. The young plants will make their appearance the next fall if the summer crop be removed from the land by the first to the middle of October.

As to the growing season, bur clover commences just about when the Bermuda pasture fails. The two plants can be used in combination with great success. The Bermuda sod should be scarified with a disc or cutaway harrow in October, and the seed sown broadcast. It will grow



FIG. 15. Alfalfa (*Medicago sativa*).

readily in the Bermuda sod, furnishing winter pasturage, and will ripen its seed and disappear in the spring about the time the Bermuda begins to grow well. It will reseed itself in the Bermuda sod as well as on open land if the seed be allowed to form during the spring. In order to secure the growth from the seed the next fall it will be necessary to again scarify the land as when the seed was originally planted. This gives the seed a chance to get down into the soil among the tangled stems of the Bermuda grass. The use of the

disc has also a good effect upon the Bermuda sod in loosening the matted growth. Professor Tracy, of Mississippi, recommends this combination very highly, saying that it will come nearer furnishing a



FIG. 16. Bur clover (*Medicago denticulata*).

continuous pasture for the Gulf States than any other mixture. This is also indorsed by experimenters in several other Southern States. Such a combination of winter and summer pasturage is much needed in the South, and planters should give it a further trial.

TRUE CLOVERS (*Trifolium* spp.).

The true clovers all belong to the genus *Trifolium*, referring to the leaf with three leaflets. Of the species discussed below the buffalo clover is an annual or biennial, crimson clover an annual, and red clover and white clover are perennials. They all produce a large number of stems and deep roots. The white clover spreads by seed and by its creeping stems; the others only by seed.

Buffalo clover (*Trifolium reflexum* L.)—This clover (fig. 17) is a native of the Eastern and Southern United States, and is either an annual or biennial in habit. It resembles the red clover, but is somewhat smaller and has nearly white flowers. In the Southern States it grows luxuriantly in fence rows, on the banks of ditches, and in similar locations. It is said not to do well in open field cultivation. Few trials have been made of its value under field conditions, but it is thought that it could be successfully grown by using some one of the cereals as a nurse crop. It grows vigorously throughout the winter, especially in the lower part of the Gulf States, and is undoubtedly worthy of more extended experiments under cultivation. Being already a native and perfectly hardy, it might well prove more valuable than crimson clover for the Southern States.



FIG. 17. Buffalo clover (*Trifolium reflexum*).

Crimson clover (*Trifolium incarnatum* L.).—This plant (fig. 18) is also called scarlet clover, German clover, Italian clover, carnation clover, and sometimes long-headed clover. It is one of the true clovers, closely related to the red clover, and resembles that plant very much, except that it is an annual. Under favorable conditions the plant makes a very vigorous growth. The root system is very large and strong, penetrating the ground to a considerable depth. From the crown of the root arise a great number of stems bearing an abundance

of soft, hairy leaves. The heads are much longer than those of red clover and are strikingly beautiful in color.

It has been cultivated as a forage plant in the warmer parts of Europe for many years. In this country it has been tried in all the Southern and Eastern States, but has not proved generally successful. It has given best results in the region of country extending southwest from New Jersey to East Tennessee and Texas. In the Southern States the results have varied widely. Some remarkably successful crops have been raised. Other planters report nothing but failures.

Its greatest use in the South is for a winter cover crop and pasture

rather than as a summer crop. Whenever it has been planted in the spring it nearly always fails to survive the summer heat. When sown as a winter crop the sowing should be as early as possible in order that the young plants should become firmly established before cold weather. Their failure to do this is no doubt responsible for many of the failures reported with fall-sown crops. In Florida or on the Gulf coast the sowing may take place as late as November, while for the higher latitudes September or October is often recommended. It is best when possible to sow from late July to early September if there is any prospect of rains to start germination. The seed should be sown at the rate of 12 to 15 pounds per acre, or rarely a little heavier. The land should be thoroughly prepared, preferably plowed just before the time of sowing, and well harrowed or pulverized. Crimson clover may also be sown and harrowed in between the rows of cotton, cowpeas, tobacco, or corn after cultivation is finished.



FIG. 18. Crimson clover (*Trifolium incarnatum*).

Ordinarily no fertilizer need be used except what is required to supply food for the crop that is to follow the clover. It has been shown by experiments carried on at the Alabama station and elsewhere that in the greater part of the South the soil does not naturally contain the germs which form the root tubercles on the various clovers and vetches. For this reason soil inoculation has been tried and is favorably recommended. This may be done in the case of crimson clover with soil taken from a field on which either red or crimson clover has been grown successfully. It is possible that many of the failures charged against crimson clover in the Southern States or in other parts of the country have been due to the absence of the nitrogen-gathering bac-

teria in the soil, and that by remedying this deficiency crimson clover may be made a profitable crop over a much wider range of country than has heretofore been the case.

A field of fall-sown crimson clover may be made to serve the triple purpose of a cover crop to prevent the washing of naked soil during winter, pasturage for stock during the winter months, and green manure to be turned under in the spring. If it is to be used for hay it should be cut before it matures, as the numerous calyx hairs in the heads then become very stiff, and when such hay is fed they are very apt to form hair balls in the stomachs of animals, often with fatal results.

Red clover (*Trifolium pratense* L.).—This well-known leguminous plant (fig. 19) has been very widely grown throughout the Southern States as a soil renovator and hay crop. It has not, however, been considered of great value for winter grazing. It is adapted to a rather wide range of soils, but of course makes the best growth where the soil is rich and in excellent condition. On any soil the seed bed should always be thoroughly and carefully prepared. If the soil is deficient in fertility it will pay to use fertilizers upon it, and in sowing even such a soil-enriching plant as red clover the increased vigor of the young plants will repay the cost of fertilizing. Seed should be sown

at the rate of 15 to 20 pounds per acre, about the 1st of October, and should be covered. In the Gulf region the clover will be able to continue its growth throughout most of the winter, and farther north growth will be maintained whenever the winter is open and mild enough. The winter pasturage afforded by red clover is excellent in quality, and, of course, while the clover is occupying the land there is no danger of washing and leaching of the soluble plant foods by winter rains.

If red clover has a tendency to be but an annual it can be made to persist from year to year by allowing it to seed before it is cut for hay in the spring or by allowing the aftermath to ripen its seed.



FIG. 19. Red clover (*Trifolium pratense*).

White clover (*Trifolium repens* L.).—This little clover (fig. 20) is now established quite widely in all of the Southern States. It is generally regarded with but little favor because of its small size, short season, and irregular appearance. It is also condemned frequently because of its salivating effect on horses. It undoubtedly has, however, much greater value than is usually acknowledged. It is one of the very earliest of plants to appear in the spring and is then eagerly grazed by all kinds of stock. During April and early May it is often the most important ingredient of pastures in the Gulf States. It opens the grazing season on natural pastures much earlier than would otherwise be possible. Its failure to appear some years is doubtless due to dry weather in the early spring. Its sudden disappearance in summer is also due to a failure of moisture. Where present even in considerable quantity it does not interfere with the growth of later pasture and



FIG. 20. White clover (*Trifolium repens*).

meadow grasses. At the same time it is quick to occupy any spots but thinly covered with other vegetation. While perhaps not worthy of cultivation in fields it is certainly of great value in the open pastures of the South.

FIELD PEA.

(*Pisum arvense* L.)

This plant (fig. 21), known also as the Canada field pea or Russian pea, is extensively cultivated in Europe, Canada, and the northern United States. It has not been regarded of much value in the South. It certainly is not when grown there as a summer crop as it is always grown in the North. Some few experiments have been made in the Southern States to determine its value as a winter and spring crop. The



FIG. 21. Field pea (*Pisum arvense*).

results so far have shown that it withstands the cold of the southern winters successfully and makes a good growth. It is probably inferior to the vetches as a winter crop. It may be sown either in the fall or as late as in January, and is preferably sown with oats or some other cereal crop at the rate of one to one and one-half bushels of peas to three-fourths of a bushel of oats per acre. The seed should either be harrowed in very deeply or plowed in to a depth of 2 inches or more. When grown in this way with oats or rye it will give an early spring crop of hay of great feeding value, or it may be grazed during the spring and then turned under for green manure. Further experiments along this line are to be encouraged.

VETCHES.

(*Vicia* spp.)

The vetches are all annual plants. With the exception of one group, including the horse bean (*Vicia faba*) and the Narbonne vetch (*Vicia narbonensis*) which are erect in habit and ought to be placed in the genus *Faba*, they are all characterized by very weak, slender stems, often larger about the middle than at the base, growing to a length of from two to four feet or more. They branch very freely and produce an abundance of compound leaves, each composed of the slender midrib, bearing several pairs of small, narrow leaflets. Each leaf terminates in a tendril. The stems are too weak to bear the great weight of the branches and foliage, and the whole plant becomes at length prostrate on the ground or nearly so. In nature, they often support themselves by twining their tendrils about the weeds and other plants among which they grow. In cultivation they should always be sown with some nurse crop which will give them the necessary support.

Carolina vetch (*Vicia caroliniana* Walt).—This vetch is a native of the Eastern and Southern States, and in some localities occurs very abundantly. It is very similar in every way to the cultivated vetches and may prove as valuable a plant as any of them if it is ever brought under cultivation. Growth begins in the early fall and continues all winter, and the plant reaches maturity in April in southern Louisiana, or May in more northern latitudes. Under cultivation the amount of grazing or of hay furnished should easily equal that secured from any other vetch. Cattle and horses eat the Carolina vetch with evident relish in the green state and the hay should prove equally palatable and nutritious. As a fertilizing plant it is certainly of value and for any desired use it has the recommendation of being a hardy native. It could be profitably used as a winter crop in an annual rotation as it matures and scatters its seeds in time to allow a summer crop to be planted on the same land. This crop in turn could be harvested in time to allow the vetch seed to germinate in the autumn.

Hairy vetch (*Vicia villosa*).—This plant (fig. 22) has been very extensively cultivated in Europe for a long time. It was first introduced into the United States about the year 1847. It did not, however, come into general cultivation at the time of its introduction, and after a few years was entirely neglected. Nothing further was done toward determining its value under cultivation in this country until some twelve or fifteen years ago, when there was a revival of



FIG. 22. Hairy vetch (*Vicia villosa*).

interest in it. From that time until the present it has been the subject of experiments in almost all the States of the Union, as well as in Canada.

It is now successfully cultivated over a very large area of country. In the North it is grown as a summer crop. In the South, however, its greatest value is for fall seeding and winter growth. It is, indeed,

probably the most valuable plant for that season which is now cultivated. It serves equally well as a cover crop, for pasturage, hay, or as a soil renovator. Like almost all the forage plants, it gives the best results when sown on rich, somewhat moist soils. It will, however, make an excellent growth on soils that are dry and somewhat sandy in character. On poor clay soils or those that are largely composed of sand, it will not, of course, give very satisfactory results. When it is desired to establish it upon such soils they should be well fertilized in order to give the vetch a good start. Through its power of absorbing the atmospheric nitrogen by means of the bacteria in the root tubercles, it will greatly enrich the soil on which it grows. A more vigorous growth of the plant, and a consequent more rapid renovation of the soil, will be obtained by fertilizing poor soils on which the vetch is sown than by leaving the enrichment of the soil entirely to the plant.

The seed should be sown in August or September, preferably at the rate of one to one and one-half bushels per acre. On account of the weakness of the stems the plants are unable to maintain an upright position, unless they are planted with some cereal crop. Winter wheat, rye, or oats may either one be used for this purpose, sowing them broadcast with the vetch seed at the rate of 1 bushel per acre. Where the seed is sown as early as recommended above, the plant will often make growth enough to furnish some grazing before the coldest weather of winter sets in. If, however, the fall rains are late and the germination of the vetch seed delayed thereby, or if the vetch be planted in October or the first of November, the plants will but barely become established before winter weather checks their growth, and no pasturage will be obtained before February. The date at which grazing may be had depends, therefore, not only upon the time of sowing, but also upon the time that the autumn rains begin, the nature of the weather during the autumn and early winter months, and the latitude in which the crop is grown. Fertility of the soil will also influence the rapidity of growth of the plant very considerably. There is generally very little growth made during the coldest part of the winter, no matter at what time or under what conditions the seed was sown and growth begun.

Grazing on the vetch crop may be continued until the end of March, when the cattle must be taken off if it is desired to secure a crop of hay. It will be ready for cutting by the last of April near the Gulf coast, or not until late in May in northern Arkansas and Tennessee. The crop should be cut just before the vetch is in full bloom. When sown alone the vetch is very difficult to mow on account of the tangled mass of the weak and trailing stems. If it be grown with any one of the cereal crops it will not be difficult to mow, and the hay can be cured with but little difficulty.

If it is not desired to save the hay, the cattle may be kept upon the

crop until the time when it is desired to plow it under. Numerous experiments have shown that it is more profitable to cut and save the hay, plowing under only the stubble, than to plow under the entire crop. Winter oats or winter rye are the cereal crops most commonly used in connection with the hairy vetch. Professor Bennett, of the Arkansas Experiment Station, recommends wheat for a nurse crop on account of its maturing more nearly at the same time with the vetch than do the other cereals.

Owing to the fact that the seed of hairy vetch is rather expensive, it is always desirable to allow the plant to reseed itself. It is possible to accomplish this whether the crop is used for pasture or saved for hay. If it is pastured through the spring, stock should be withdrawn in time to allow a sufficient quantity of seed to ripen and scatter before the date when it is desired to plow under the vetch in order to plant the land in some summer crop. If the crop is to be used for hay, the reseedling of the land may be assured in several ways. The mowing may be deferred until a sufficient number of the earliest seeds have matured and fallen. The crop may be cut very early and sufficient second growth obtained to reseed the land before the time for plowing under arrives, or the sickle bar may be raised high enough to leave the lower part of the plant with the attached seed pods uncut, and the seed thus left may be allowed to ripen and scatter after the hay is removed.

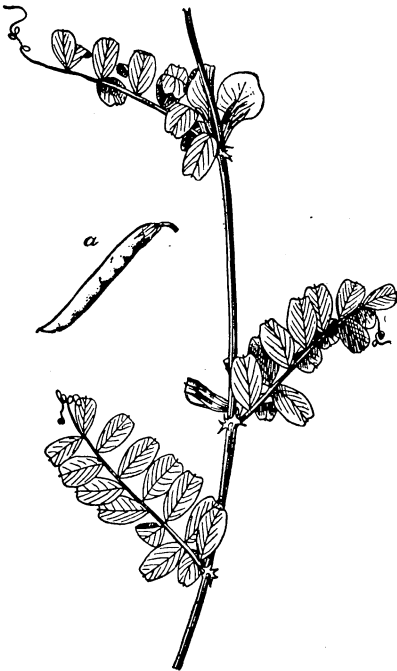


FIG. 23. Spring vetch (*Vicia sativa*).

Louisiana vetch (*Vicia ludoviciana* Nutt.).—The Louisiana vetch very closely resembles the Carolina vetch in appearance and habit. It is native in the region about New Orleans, and probably throughout the low coastal plain of the Gulf States. It might profitably be introduced into cultivation in those regions where it is native, as it makes a vigorous growth and the stock running at large in the woods appear to graze it readily where accessible.

Spring vetch (*Vicia sativa* L.).—The spring vetch (fig. 23), or, as it is often called, tares or smooth vetch, has been under cultivation in Europe for many centuries. It was long ago introduced into this country and has been quite extensively tried. For winter use in the

Southern States it has been given extended trials and has proved decidedly inferior to the hairy vetch in all respects. It is possible that on some moist, heavy soils it may do better than the hairy vetch, but outside of this it is not to be recommended. The nutritive value is equally high, but it is much less prolific in yield and is very susceptible to the influence of dry weather. The time and manner of seeding, its uses, and treatment are all similar to those of the hairy vetch. It has been determined by experiments at the Alabama Experiment Station that soil in which spring vetch had been successfully grown contained the proper germs for producing the root tubercles on the hairy vetch. Farmers who have grown the spring vetch on their plantations should remember this when they desire to start new fields of the hairy vetch.

WINTER FLAT-PEA, OR WINTER VETCH.

(*Lathyrus hirsutus* L.)

This plant (fig. 24) is closely related to the everlasting flat-pea, so widely advertised a few years ago. It was introduced into this country from Italy, where it is commonly used as a winter soiling crop. In this country it is of value only in the Southern States, because it is not hardy enough in the north. The latitude of Washington (D. C.) and Kentucky is about the northern limit of successful cultivation.

In the habit and manner of growth the plant resembles the hairy vetch. It has a long, weak, trailing stem, and an abundance of small leaves. In the field it forms a dense mat-like growth, often to a depth of 12 to 18 inches.

The seed may be sown from August until October, depending on the latitude, moisture, and season when it is wished to produce forage. The proper mixture for sowing is about two bushels of flat-pea seed and one bushel of either winter oats or winter rye. If the seed is sown in August or early September, and the autumn rains commence then so as to cause germination, it will make a strong enough growth to provide grazing during November and December. The strong root system, however, develops slowly, and as the plant does not make much stem growth until the roots have become well established it commonly does not furnish pasturage before January or February. The growth then



FIG. 24. Winter flat-pea (*Lathyrus hirsutus*).

continues until April or early May, when the crop is ready to cut for hay.

The hay is a rather difficult one to cure properly on account of the heavy tangled growth of the vines. When grown with some cereal crop, as they ought always to be, the peas grow much more readily than when grown alone. In the latter case it is very difficult to cut them with a mowing machine. The great weight of the weak vines causes them to lie flat on the ground. Winter flat-pea hay is not much more difficult to cure well than alfalfa or cowpeas, and to prevent heating must be handled as carefully as these other leguminous hays. Stock of all kinds eat the hay readily, and horses are said to prefer it to hairy vetch. The winter flat pea has given some excellent results in the Gulf States. In Louisiana it was first planted several years ago and has now become established on the station grounds at Audubon Park, New Orleans, where it makes a luxuriant growth every fall and winter. Like the hairy vetch it reseeds itself freely.

YELLOW LUPINE.

(*Lupinus luteus* L.)

The yellow lupine has long been used as a soil-renewing crop in Europe, where it is also made use of as forage. It has been recommended for cultivation in this country, but so far has proved of very little value anywhere. It is said that the plants are readily eaten by all kinds of stock, especially in the green state. Observations made by the writer at the State experiment stations of Mississippi and Louisiana during February of this year do not confirm this. The lupines were growing vigorously at that time at both stations, but at the Mississippi station, where young cattle had been admitted to them freely, they did not appear to be relished by the stock, although very little other green forage could be obtained. The yellow lupine is an annual plant and is sown at the rate of 90 pounds of seed per acre. There is no doubt that when sown in the fall, in the Southern States, especially near the Gulf, it will grow well during the winter months and furnish a considerable amount of green forage. If, however, experience proves that it is not generally relished by stock its cultivation is not to be recommended. More extended trials of this species and the closely related white lupine (*Lupinus albus*) are needed to thoroughly determine their value.

RAPE.

(*Brassica napus* L.)

Rape is a plant of the mustard family, very closely related to the cabbage, turnip, and to the common wild mustards of our fields and gardens. It is native to northern Europe and has long been cultivated in the Old World. Not many years ago it was introduced into this country and is now widely and favorably known in the Northern and

Northwestern United States as a very valuable catch crop for soiling and pasture. It was first introduced into the South several years ago and experiments with it have been made in practically all of the Southern States. In these States it is better adapted for a winter crop than for spring seeding, although some experimenters have reported excellent results from seed sown in the early spring. The varieties suited for winter culture are biennials, while the summer varieties are annuals.

Rape gives the best results when grown in a rich, moist loam. It will, however, do well on all soils except very light sands or heavy clays. Such soils are always deficient in vegetable matter. Rape is a very strong feeder and takes from the soil about the same food materials as does corn. For this reason these two crops should not be grown in immediate succession, but rape should follow some other crop. It has been found that a crop of rape grown on land which had produced several consecutive crops of wheat greatly improved the yield of the wheat crop which succeeded it. This fact, however, will be of but little importance in most of the South, where wheat is grown but sparingly. Seed should be sown in the Southern States in September or early October. From 2 to 4 pounds per acre, according to the quality and condition of the soil, is the amount ordinarily used. It may be sown broadcast with good results, although in the North it is usually drilled in rows 24 to 28 inches apart and cultivated.

Rape is able to endure quite severe cold weather, and the fall planted seed coming up with autumn rains will continue its growth throughout the winter. The growth will not be as rapid under these conditions as it is when grown for a summer crop. In summer five or six weeks will often bring the plants to a size suitable for soiling purposes. As a winter crop in the South it will make an excellent light pasturage for swine, sheep, or calves. It is equally suitable for larger stock, but they are apt to pull up large numbers of the plants while feeding and to trample much of the crop into the ground. When it is desired for such stock it is best to cut it and feed green. In pasturing any stock, except hogs, on rape a care should be taken not to allow the animals to graze too freely upon it at first, as there is danger of injury from bloating. They should be allowed upon it for only a short time at the first and never when the plants are wet from rain or frost. It is recommended that when used as a pasture stock should have access to some other pasture crop at the same time. Salt should always be conveniently provided for all stock pasturing on this crop. On account of the high feeding value of rape it is an especially desirable crop to grow. It will fatten stock grazing upon it, and for dairy cattle will maintain a large flow of milk during the fall and winter months when green food is usually difficult to obtain.

FARMERS' BULLETINS.

The following is a list of the Farmers' Bulletins available for distribution showing the number, title, and size in pages of each. Copies will be sent to any address on application to Senators, Representatives, and Delegates in Congress, or to the Secretary of Agriculture, Washington, D. C.:

16. Leguminous Plants. Pp. 24.
19. [Superseded by No. 127.]
21. Barnyard Manure. Pp. 32.
22. The Feeding of Farm Animals. Pp. 32.
23. [Superseded by No. 142.]
24. Hog Cholera and Swine Plague. Pp. 16.
25. Peanuts: Culture and Uses. Pp. 24.
26. [Superseded by No. 129.]
27. Flax for Seed and Fiber. Pp. 16.
28. Weeds: And How to Kill Them. Pp. 32.
29. Souring and Other Changes in Milk. Pp. 23.
30. Grape Diseases on the Pacific Coast. Pp. 15.
31. Alfalfa, or Lucern. Pp. 24.
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